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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/455,408	12/06/1999	SYLVAIN SARDA	612.37806X00	5076

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EXAMINER
DAY, HERNG DER

ART UNIT	PAPER NUMBER
2123	

DATE MAILED: 02/12/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/455,408	SARDA, SYLVAIN	
	Examiner	Art Unit	
	Herng-der Day	2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 December 1999* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *06 December 1999* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *4* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

1. Claims 1-6 have been examined and claims 1-6 have been rejected.

Priority

2. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Drawings

3. The drawings are objected to for the following reasons. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

3-1. The Draftsperson has objected to the drawings; see the copy of Form PTO 948 for an explanation.

3-2. The drawings of FIG. 1 to FIG. 3 are objected to because they are not translated into English completely.

3-3. The drawings are objected to under 37 CFR 1.83(a) because they fail to show the dynamic simulation and the solution algorithm as described in the specification. Any structural detail that is essential for a proper understanding of the disclosed invention should be shown in the drawing. MPEP § 608.02(d).

Specification

4. The disclosure is objected to because of the following informalities:

Appropriate correction is required.

4-1. As described in lines 2-3 of page 12, "the following equation which corresponds to relation 1", however, two equations, line 20 of page 1 and line 8 of page 9, are designated as (1).

4-2. All dots in all equations are not positioned properly.

4-3. ϕ_m, as described in line 4 of page 17, has been defined in lines 9-10 of page 13 as "ϕ_m is the pore volume of the matrix block, i.e. the volume of the block multiplied by the porosity of the matrix". Therefore, using ϕ_m for matrix porosity is contradictory.

Claim Objections

5. A series of singular dependent claims is permissible in which a dependent claim refers to a preceding claim which, in turn, refers to another preceding claim.

A claim, which depends from a dependent claim, should not be separated by any claim which does not also depend from said dependent claim. It should be kept in mind that a dependent claim may refer to any preceding independent claim. In general, applicant's sequence will not be changed. See MPEP § 608.01(n).

Claim Rejections - 35 USC § 112

6. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

7. Claims 1-6 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

For example, as described in lines 12-14 of page 12, "The pore volumes of the fracture meshes and of the matrix blocks (ϕ_i) are known by means of the mesh pattern", however, the pore volumes calculation of the fracture meshes has not been disclosed in the specification. The porosity of fracture meshes has not been provided as input data. Accordingly, it would require undue experimentation for one skilled in the art to make and/or use the invention when calculating the accumulation term (A_i) of the fracture mesh as shown in equations at page 14.

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claims 1-6 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

9-1. Claim 1 recites the limitation "the various fracture intersections" in lines 4-5 of the claim. There is insufficient antecedent basis for this limitation in the claim.

9-2. Claim 3 recites the limitation of delimiting matrix volume associated with each fracture mesh. However, it fails to further limit the subject matter of claim 2 and destroys the limitation recited in claim 2. For the purpose of claim examination, the Examiner will presume that claim 3 is a dependent claim of claim 1.

9-3. Claim 4 recites the limitation "the transmissivity value" in lines 1-2 of the claim. There is insufficient antecedent basis for this limitation in the claim. For the purpose of claim

examination, the Examiner will presume that "the transmissivity value" as described in claims 4 refers to "a transmissivity value".

9-4. Claim 5 recites the limitation "the transmissivity value" in line 2 of the claim. There is insufficient antecedent basis for this limitation in the claim. For the purpose of claim examination, the Examiner will presume that "the transmissivity value" as described in claims 5 refers to "a transmissivity value".

9-5. Claim 6 recites the limitation "the transmissivity value" in line 2 of the claim. There is insufficient antecedent basis for this limitation in the claim. For the purpose of claim examination, the Examiner will presume that "the transmissivity value" as described in claims 6 refers to "a transmissivity value".

9-6. Claim 2 is rejected as being dependent on a rejected claim.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. Claims 1-2 and 4-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cacas et al., UK Patent Application GB 2322948 published September 9, 1998 (U.S. equivalent Patent 6,023,656, issued February 8, 2000), in view of Jones et al., "Control-Volume Mixed Finite Element Methods", Computational Geosciences, 1, 1997, pages 289-315.

11-1. Regarding claims 1-2 and 4-5, Cacas et al. disclose a method for modelling fluid flows in a fractured multilayer porous medium in order to simulate interactions between pressure and flow rate variations in a well running across said medium, characterized in that the fractured medium is discretized by means of a mesh pattern wherein the fracture meshes are centred on nodes at the various fracture intersections (nodes, page 13, lines 10-15) and flows are determined between each fracture mesh and the associated matrix volume in a pseudosteady state (transmissivity factor, page 15, lines 3-15, therefore, will be constant).

However, Cacas et al. fail to expressly disclose:

(1) each node being associated with a matrix volume;

(2) the matrix volume associated with each fracture mesh is delimited in each layer by all of the points that are closer to the corresponding node than to neighboring nodes;

(3) the pressure varies linearly as a function of the distance.

Jones et al. disclose a control-volume mixed finite element method that provides a simple, systematic, easily implemented procedure for obtaining accurate velocity approximations on irregular block-centered grids because a key ingredient in simulation of flow in porous media is accurate determination of the velocities that drive the flow (abstract, page i). Specifically, Jones et al. disclose the missing elements:

each node being associated with a matrix volume (With each vertex, one associates a control volume, page 4, lines 40-42);

the matrix volume associated with each fracture mesh is delimited in each layer by all of the points that are closer to the corresponding node than to neighboring nodes. (control volume,

usually found by taking the Voronoi volume bounded by the perpendicular bisectors of the sides of the triangles, page 4, lines 40-42);

a transmissivity value is determined for each fracture mesh - matrix block pair by considering that the pressure varies linearly as a function of the distance from the point considered to the fracture mesh associated with the block (p is linearly interpolated from the vertices to the interior, page 4 line 42 through page 5, line 1).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Cacas et al. to incorporate the teachings of Jones et al. to obtain the invention as specified in claims 1-2 and 4-5 because the control-volume mixed finite element method disclosed by Jones et al. provides a simple, systematic, easily implemented procedure for obtaining accurate velocity approximations that drive the flow in porous media (Jones, abstract, page i).

12. Claims 3 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cacas et al., UK Patent Application GB 2322948 published September 9, 1998 (U.S. equivalent Patent 6,023,656, issued February 8, 2000), in view of Sarda et al., UK Patent Application GB 2322949 published September 9, 1998 (U.S. equivalent Patent 6,064,944, issued May 16, 2000).

12-1. Regarding claims 3 and 6, Cacas et al. disclose a method for modelling fluid flows in a fractured multilayer porous medium in order to simulate interactions between pressure and flow rate variations in a well running across said medium, characterized in that the fractured medium is discretized by means of a mesh pattern wherein the fracture meshes are centred on nodes at the various fracture intersections (nodes, page 13, lines 10-15) and flows are determined between

each fracture mesh and the associated matrix volume in a pseudosteady state (transmissivity factor, page 15, lines 3-15, therefore, will be constant).

However, Cacas et al. fail to expressly disclose:

(1) each node being associated with a matrix volume;

(2) each fractured layer is discretized in pixels and the matrix volume associated with each fracture mesh is delimited by determining the distance from each pixel to the closest fracture mesh;

(3) determine a transmissivity value.

Sarda et al. disclose a method, based on a pixel representation of the medium, which determines the dimensions of equivalent blocks. With this method, a number of different transfer functions applied to any type of heterogeneous medium can be easily and rapidly computed (method, page 8, lines 1-13). The transfer function may represent variations between different parts of the geological medium, variations in distances, transmissivities or heat (function, page 6, line 26 through page 7, line 4). Specifically, Sarda et al. disclose the missing elements:

each node being associated with a matrix volume (transposed medium, page 7, lines 5-12);

each fractured layer is discretized in pixels (array of pixels, page 7, lines 14-15) and the matrix volume associated with each fracture mesh is delimited by determining the distance from each pixel to the closest fracture mesh (distance, page 7, lines 16-26);

a transmissivity value is determined for each fracture mesh - matrix block pair by considering that the pressure varies linearly as a function of the distance from the point

considered to the fracture mesh associated with the block (the "distance between pixels" function may express the transmissivity values, page 20, lines 14-20).

In order to model fluid flows in a fractured multiplayer porous medium, one of ordinary skill in the art would be motivated to solve problems of heterogeneous medium because it most likely exists in a multiplayer porous medium.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Cacas et al. to incorporate the teachings of Sarda et al. to obtain the invention as specified in claims 3 and 6 because with the teachings of Sarda et al. a number of different transfer functions applied to any type of heterogeneous medium can be easily and rapidly computed (Sarda, page 8, lines 1-13).

Conclusion

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Reference to Cacas et al., U.S. Patent 6,023,656 issued February 8, 2000, and filed December 30, 1997, is cited as U.S. equivalent Patent of UK Patent Application GB 2322948, published September 9, 1998.

Reference to Rahon et al., U.S. Patent 6,038,389 issued March 14, 2000, and filed February 12, 1998, is cited as disclosing a method of modeling a physical process in a material environment.

Reference to Sarda et al., U.S. Patent 6,064,944 issued May 16, 2000, and filed December 30, 1997, is cited as U.S. equivalent Patent of UK Patent Application GB 2322949, published September 9, 1998.

Reference to Noetinger et al., U.S. Patent 6,094,619 issued July 25, 2000, and filed July 2, 1998, is cited as disclosing a method for determining large-scale representative hydraulic parameters of a fractured medium.

Reference to Farmer, U.S. Patent 6,106,561 issued August 22, 2000, and filed March 4, 1998, is cited as disclosing a simulation gridding method.

Reference to Barnette, U.S. Patent 6,356,860 issued March 12, 2002, and filed October 8, 1998, is cited as disclosing a method of grid generation.

Reference to Berryman et al., "The Elastic Coefficients of Double-Porosity Models for Fluid Transport in Jointed Rock", J. Geophys. Res., 100, 24,611-24,627, June 1995, is cited as disclosing double-porosity models.

Reference to Frolkovic, "Finite Volume Discretizations of Density Driven Flow in Porous Media", In: Finite Volumes for Complex Applications (Benkhaldoun F, Vilsmeier R., eds.), Hermes, Paris, 1996, pages 433-440, is cited as disclosing finite volume discretizations.

Reference to Fuhrmann et al., "Stability and Existence of Solutions of Time-Implicit Finite Volume Schemes for Viscous Nonlinear Conservation Laws", Preprint 437, Weierstraβ Institute, Berlin September 25, 1998, pages 1-20, is cited as disclosing the definition of Voronoi box.

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Herng-der Day whose telephone number is (703) 305-5269. The examiner can normally be reached on 8:30 - 17:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kevin J Teska can be reached on (703) 305-9704. The fax phone numbers for the

organization where this application or proceeding is assigned are (703) 746-7239 for regular communications and (703) 746-7238 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3900.

Herng-der Day
February 7, 2003

HUGH JONES Ph.D.
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